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Date: December 27, 2010 Name: Jasper W. Dockrey, Reg. 33,868 Signature: /Jasper W. Dockrey/

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Appln. of: Aspar et al.

Appln. No.: 10/534,199

Filed: May 6, 2005

For: METHOD FOR FORMING A BRITTLE ZONE IN A SUBSTRATE BY CO-IMPLANTATION

Attorney Docket No: 9905/25(BIF023239/USA)

Examiner: Bradley Smith

Art Unit: 2894

Confirmation No. 1400

APPEAL BRIEF

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

This Appeal Brief is submitted pursuant to the Notice of Appeal filed, November 3, 2010.

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REAL PARTY IN INTEREST

The real party in interest is Commissariat A L'Energie Atomique Et Aux Energies Alternatives, formerly known as the Commissariat à L'Energie Atomique, the assignee of the above-referenced patent application.

RELATED APPEALS AND INTERFERENCES

This appeal involves the final rejection of all of the pending claims in U.S. Patent Application No.10/534,199. There are no other related appeals or interferences involving this application or its subject matter.

STATUS OF CLAIMS

Claims 1-23 are pending in the application and have been rejected. This appeal involves all of the pending claims, which are presently under a final rejection set forth in an Office Action mailed August 4, 2010.

STATUS OF AMENDMENTS

In response to the Office Action of August 4, 2010, the appellant filed a Notice of Appeal on November 3, 2010. No amendments have been filed subsequent to Office Action of August 4, 2010, and all of the amendments previously filed by the appellant have been acted upon by the Examiner during the course of prosecution.

SUMMARY OF CLAIMED SUBJECT MATTER

The invention relates to a method for fabricating a thin layer, and to a thin layer fabricated by the method of claim 1. The method includes implanting a first chemical species in a substrate at a first depth to form a weak buried region. At least one second chemical species is implanted in the substrate at a second depth different from the first depth and at an atomic concentration higher than the atomic concentration of the first chemical species. An example of this process is illustrated in FIGs. 3a and 3b of the appellant's drawing.

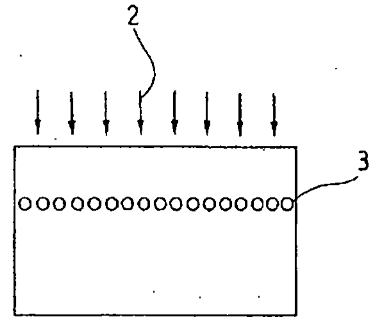

Fig. 3a

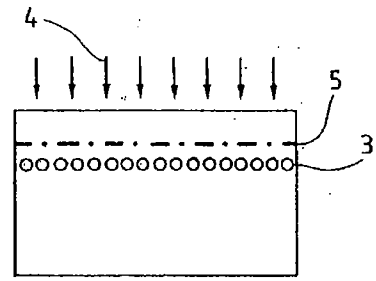

Fig. 3b

The implantation of the first and second chemical species can be carried out in any order. (Specification, pg. 6, ll. 1-10). In the example shown above, the arrows designated by element number (2) represent the implantation of the second chemical species and the arrows identified by element (4) represent the implantation of the first chemical species. The location of the second chemical species in the substrate is indicated by the circles designated as element number (3), and the location of the first chemical species and the buried weak region are indicated by the dashed line designated as element number (5). (Specification, pg. 9, ll. 30-35, pg. 10, ll. 1-5). The relative depth of the first and second species in the substrate can be the same as that shown above or the inverse. (Specification, pg. 7, ll. 25-34). In accordance with the invention, the second chemical species is less effective than the first chemical species at weakening the substrate and resides outside of the weak buried region. (Specification, pg. 6, ll. 5-9).

Following implantation of the first and second chemical species, at least a portion of the second chemical species is diffused from the second depth into the weak buried region. (Specification, pg. 10, ll. 11-15). This process is illustrated in FIG. 3c of the appellant's drawing.

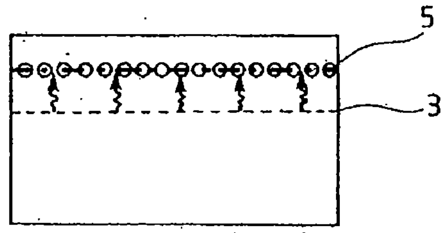

Fig. 3c

Either during or after at least a portion of the second chemical species is diffused into the burier weakened region; a fracture is initiated along the first depth. As illustrated in FIG. 3d of the appellant's drawing, the fracture splits a thin layer (6) from the substrate.

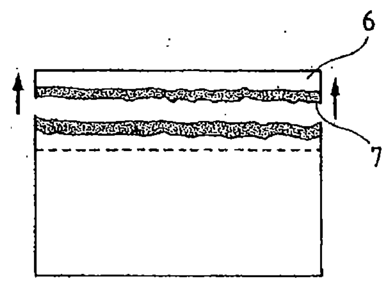

Fig. 3d

Initiating a fracture can be accomplished by use of a heat treatment or by applying mechanical stresses. (Specification, pg. 10, ll. 23-27). Where the fracture is initiated by applying a heat treatment, both diffusing at least a portion of the second chemical species and initiating the fracture can be carried out simultaneously. (Specification, pg. 10, ll. 28-31). A handle support (not shown) can be applied to the substrate before or during initiating the fracture to receive the thin layer (6) following splitting from the substrate. (Specification, pg. 11, ll. 13-15).

The inventive method is carried out such a heat treatment is applied for less time and at a lower temperature then that necessary in the absence of the second chemical species or by implanting an additional amount of the second chemical species to avoid exceeding a predetermined time/temperature regime. (Specification, pg. 12, ll. 12-16). The predetermined time/temperature regime is known to those skilled in the art as the "thermal budget." (Specification, pg. 8, ll. 11-22). In one aspect of the inventive method, the heat treatment is applied within a first thermal

budget, where the first thermal budget is lower than a second thermal budget that would be necessary to initiate the fracture in the absence of implanting and diffusing the second chemical species. *Id.* In another aspect, the heat treatment is carried out within a first thermal budget by implanting an additional amount of the second chemical species, such that the first thermal budget is lower than a second thermal budget required in the absence of the additional amount of the at least one second chemical species. *Id.*

An example is provided in the appellant's specification describing implantation of hydrogen (H) and the rare gas neon (Ne) in a silicon (Si) substrate, in which the Ne is diffused to the vicinity of the H implant region. (Specification, pg. 12, ll. 19-31). Another example includes implantation of hydrogen (H) and the rare gas helium (He) in a germanium (Ge) substrate, in which the He is diffused to the vicinity of the H implant region. (Specification, pg. 12, ll. 32-35, pg. 13, ll. 1-9). Yet another example includes implantation of hydrogen (H) and the rare gas helium (He) in a Si substrate, in which the He is diffused to the vicinity of the H implant region. (Specification, pg. 13, ll. 10-29).

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The Examiner rejected claims 1-3, 5, 8-12, 14-18, and 21-23 have been rejected under 35 U.S.C. § 103(a) as obvious over Venezia et al. Although not precisely stated in the Office Action of August 4, 2010, it is the appellants understanding that the obviousness rejection is based on Venezia et al. in view of Agarwal et al. The first issue to be decided on appeal is whether claims 1-3, 5, 8-12, 14-18, and 21-23 are unpatentable under 35 U.S.C. § 103(a) in view of Venezia et al. and Agarwal et al.

The Examiner also rejected claims 4 and 9 under 35 U.S.C. § 103(a) as being unpatentable over in view of Venezia et al. and Agarwal et al. and further in view of Duo et al. The second issue to be decided on appeal is whether claims 4 and 9are

unpatentable under 35 U.S.C. § 103(a) in view of Venezia et al. and Agarwal et al. and further in view of Duo et al.

The Examiner also rejected claims 6-7, 13, and 20 under 35 U.S.C. § 103(a) over Agarwal et al. and Venezia et al. and further in view of JP 11-087668 to Kinji. The third issue to be decided on appeal is whether 6-7, 13, and 20 are unpatentable under 35 U.S.C. § 103(a) in view of Venezia et al. and Agarwal et al. and further in view of Kinji.

Claims 1-4 and 10-20 will stand separately for purpose of appeal from claims 8-9, 21-23. Further, the patentability of the claims identified by the headings noted below is individually asserted.

The claims at issue are set forth in the Claims Appendix.

ARGUMENT

The appellant asserts that the pending claims are not obvious in view of Venezia et al., Agarwal et al. Duo et al., and Kinji, taken alone or in combination. Upon consideration of the scope and content of the prior art, the differences between the claimed invention and the prior art, and the level of ordinary skill in the art in relation to combining the cited references, it is apparent that these references do not establish a *prima facie* case of obviousness.

In determining whether the claimed subject matter would have been *prima facie* obvious to one skilled in the art at the time the invention was made, the trier of fact must consider (1) the scope and content of the prior art, (2) the differences between the art and the claims at issue, and (3) the level of ordinary skill in the art. Other objective evidence may be considered, such as commercial success, a long-felt need, failure of others, copying, praise by persons in the industry, departure from accepted principles, and wide-spread recognition in the art of the invention's significance. *Graham v. John Deere Co.*, 383 U.S. 1, 17-18, 148 USPQ 459, 467 (1966).

I. THE SCOPE A`ND CONTENT OF THE CITED PRIOR ART

A. Agarwal et al.

Agarwal et al. disclose implanting a combination of hydrogen and helium in a silicon substrate. (Pg. 1086, column 2). This article discloses a synergistic effect from the implanted combination that results in the need for less hydrogen for separation and transfer of a thin film. (Pg. 1088, column 1). Agarwal et al. disclose implanting H^+ at 30 keV and He^+ at 33 keV. In one disclosed combination, H^+ is implanted at a dose of 7.5 E15 and He^+ is implanted at a dose of 1 E16. The technical publication by Agarwal et al. is referenced in the appellant' specification and describes a process in which the implantation profiles of hydrogen (H) and helium (He) are localized to the same depth in the substrate. The appellant describe this reference in their specification as follows:

> The paper "Efficient production of silicon-on-insulator films by co-implantation of He^+ with H^+" by Agarwal et al. (Appl. Phys. Lett., Vol. 72, No 9, March 1998) describes a method comprising the co-implantation in a silicon substrate of two chemical species, namely hydrogen and helium. The authors specify that the implantation profiles of the two implanted species must be localized to the same depth. It is thus possible to reduce the total dose implanted and enabling subsequent fracture, compared to using either of the two chemical species alone: according to the authors, this technique reduces the total dose implanted by an amount of the order of 50%. The authors also disclose that the order in which the two implanted species are implanted is important: the hydrogen must be implanted first, and the helium second; they assert that if the helium were implanted first the reduction in the total dose implanted would be less. (Specification, pg. 3, ll. 28-35; pg. 4, ll. 1-5).

Agarwal et al. do not mention any details regarding a technique to improve the quality of the thin film. Instead, as described by the appellant in their specification, Agarwal et al. teach that implanting hydrogen and helium reduces the total implant dose compared to using either of the two chemical species alone.

B. **Venezia et al.**

Venezia et al. was published in 1998 by four of the same authors as the Agarwal et al. reference and also by two additional authors. The appellant asserts that the process described by Venezia et al. is substantially similar to that disclosed in Agarwal et al.

Venezia et al. describe an exploratory experimental work in which the degree of lattice damage and blister formation is explored for different processing conditions (See, Abstract). Venezia et al. are interested in the amount of substrate damage induced by the implantation of helium. (Pg. 1386, second full paragraph). In particular, Venezia et al. state that they "have separated the damage induced by He, the co-implanted ion, from the physical effects of the He gas in the following ways." In one set of experiments, He was implanted deeper than H, separating most of the damage from the He implant from the location of the H implant." They further state that "the He implant played little role in improving the efficiency of the formation of surface blisters at lower doses." (Pg. 1386, *Id.*)

To investigate the crystalline damage individually caused by H and He, Venezia et al. describe an experiment in which helium is implanted to a deeper depth than hydrogen. (Pg. 1387, third paragraph). Optical micrographs of surface blistering from the deeper He implant were compared with a sample implanted with He at the same depth as the H. (Venezia et al., Pg. 1388, leading paragraph). Venezia et al. state that "[s]ince the blistering remained essentially unchanged as a result of placing the He damage deeper than the H damage, we can conclude that the effects of the damage induced by the He did not play a significant role in enhancing the formation of the surface blisters at lower doses." (Venezia et al., Pg. 1388, *Id.*).

In another experiment, the H and He implant doses were reversed as compared to the previous experiment, and the implanted sample was annealed at a lower temperature and for a shorter time. (Venezia et al., Pg. 1388, leading paragraph). The lower annealing time and temperature avoided blister formation. The implant profile of He from this experiment is shown in the SIMS analysis below.

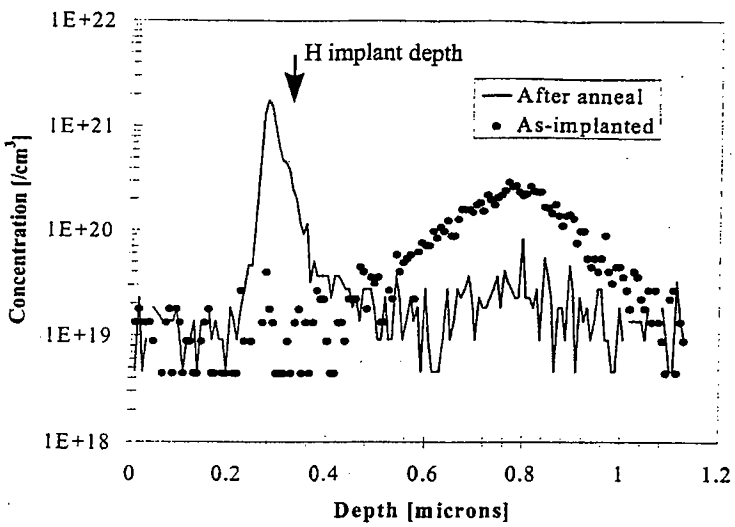

Figure 2. SIMS concentration profile vs depth for 30 keV 3x10^{16} H/cm^2 + 130 keV 1x10^{16} He/cm^2 annealed at 450°C / 15 min.

The figure shows the as-implanted He profile by the dotted line. The solid line shows the He profile after annealing. A reference point showing the H implant depth is also shown in this figure. Venezia et al. note that the He distribution was very broad and located deeper than the H profile. (Venezia et al., Pg. 1388, leading paragraph). The profiles of FIG. 2 show that if the helium distribution is deeper than hydrogen before annealing, the He diffuses to the hydrogen implant region after annealing. The appellant asserts that the noted He diffusion characteristics are the reason that Venezia et al. state: "*it is simply the presence of the He gas in the H-rich region that leads to the formation of the surface blisters, and presumably makes the thin-film separation process more efficient.*" (*Id.* last sentence of leading paragraph). Said differently, the implantation at different depths is useless and thus not recommended by Venezia et al. As stated in the beginning of the first paragraph in page 1388: "*Comparison of Figs. 1a and 1b shows that separating the implant profiles had no significant effect on the surface blistering*".

Accordingly, the appellant asserts that Venezia et al. teach that it is preferable to implant hydrogen and helium to the same depth in the substrate. Indeed, Venezia et al. ultimately conclude that "[t]he presence of He in the region of the H implant was shown to make the process of surface blistering more efficient." (Venezia et al., pg. 1389, first full paragraph). Accordingly, Venezia et al. clearly teach that implantation of helium and hydrogen is more efficient when carried out at the same implant depth.

C. **Duo et al.**

Duo et al. disclose implantation and annealing of hydrogen and helium. This article explores the effects of changes in the order of implantation and different annealing conditions on the degree of exfoliation silicon substrates. Duo et al. investigated the order of implantation of helium and hydrogen with respect to density of atoms and positron traps. (Abstract). Duo et al. conclude that in helium-implanted first samples, the helium could not move to the hydrogen-distributed region. (Pg. 482, first column). Duo et al. ultimately concluded that "[i]t is not so efficient to exfoliate the surface in the samples implanted with helium first than in the samples implanted with hydrogen first." (Pg. 482, second column).

D. **Kenji**

Kenji discloses a process in which helium and hydrogen are implanted into a substrate (111) followed by applying a support board (12), applying heat, and separating the implanted substrate. (English Translation, Pg. 5-6, ¶¶ 0006-0007). Kenji teaches implantation of the chemical species into the same region of the substrate. The appellant refers to the English Translation of the Japanese text submitted with their Information Disclosure Statement of **January 25, 2007**. In the translated text, paragraph 0009 describes the implantation of helium ion, (He^+) or molecular hydrogen ion (H_2^+). The ion implantation region (11b) is described as being formed in parallel with the oxidizing zone (11a). The appellant notes that in the examples of implantation presented by Kenji, helium ions are implanted at 90keV and

molecular hydrogen ions are implanted at 120keV. (English Translation, pg. 8-9, ¶ 0012). Accordingly, the appellant assert that the helium ions and molecular hydrogen ions are implanted in close proximity to one another.

II. THE DIFFERNCES BETWEEN CLAIMS 1-3, 5, 11-12, AND 14-18 AND THE CITED REFERNCES

Claims 1-3, 5, 10-12, and 14-18 stand rejected over Venezia et al. and Agarwal et al. Independent claim 1, recites a method for fabricating a thin layer by implanting a first chemical species in a substrate at a first depth to form a weak buried region. At least one second chemical species is implanted in the substrate at a second depth different from the first depth, and at a higher atomic concentration than the first chemical species. The second chemical species resides outside of the weak buried region. The method also includes diffusing at least a portion of the at least one second chemical species from the second depth into the weak buried region. Then, the thin layer is fabricated by initiating a fracture along the first depth. The appellant' assert that neither Venezia et al. nor Agarwal et al., taken alone or in combination, do not suggest or disclose the method recited by claim 1.

As set forth above, Agarwal et al. describe a process in which the implantation profiles of hydrogen (H) and helium (He) are localized to the same depth in the substrate. The Examiner acknowledges that Agarwal et al. fail to disclose the implantation of He at a different depth than H in a substrate. (Office Action, Pg. 2). As set forth above, Venezia et al. describe a process in which hydrogen and helium are implanted to produce an overlapping profile. The Examiner asserts that Venezia et al. disclose implanting helium in a substrate, such that the helium resides outside of the weak buried region. (Office Action, Pg. 3).

In contrast to the processes disclosed by Venezia et al. and Agarwal et al., claim 1 recites, *inter alia*, that a second chemical species (in one embodiment He), is implanted to reside outside the weak buried region (in one embodiment formed by H), and at least a portion is diffused into the weak buried region. Agarwal et al. does not

suggest or disclose implanted one species to reside outside the weak buried region. Venezia et al. do not overcome the deficiencies of Agarwal et al. While, Venezia et al. disclose an experiment in which He was implanted deeper than H, they do not recognize any benefit from their experiment, and teach that implantation of helium and hydrogen is more efficient when carried out at the same implant depth.

Claims 2 and 3 depend from claim 1 and recites particular depth relationships between the first and second species in which the second species is at a greater depth than the first species. As asserted above, Agarwal et al. disclose implanting hydrogen and helium at the same depth, and Venezia et al. discourage implanting at different depths in a thin film process. This stands in sharp contrast to the method of claims 2 and 3.

Claim 5 is allowable at least in view of the amendment and remarks pertaining to claim 1 from which it depends.

Claim 10 depends from claim 5 and recites different heat treatment methods. This claim is allowable at least in view of the remarks pertaining to claim 1 from which it indirectly depends.

Claims 11-12 depend directly and indirectly from claim 1, respectively, and recite application of mechanical stress to initiate the fracture of the thin layer. The appellant does not understand Agarwal et al. to disclose a facture process as set forth by claim 1. This reference discloses application of a handle wafer, but once the handle wafer is bonded, the wafers are cut into pieces. (Pg. 1086, right column, ll. 19-21). The Examiner asserts that Agarwal et al. disclose applying shear stress to separate the thin film. (Office Action, pg. 3, ll. 6-8). The description by Agarwal et al. of a shear process to separate a thin film is in reference to the prior art process of Bruel. (Pg. 1086, left column, ll. 3-6). The appellant asserts that Agarwal et al. are not describing an improved thin layer formation process as recited by claim 1. Accordingly, claim 11-12 distinguish over Agarwal et al.

Claims 14-18 depend directly or indirectly from claim 1. These claims are allowable at least in view of the remarks pertaining to claim 1.

Dependent Claims 4 and 19

Claims 4 and 19 stand rejected over Agarwal et al. and Venezia et al. in view of Duo et al. Claim 4 depends from claim 2 and recites that implanting at least one second chemical species is carried out before implanting the first chemical species. Thus, the second species is implanted to a greater depth in the substrate than the first species and is implanted before the first species.

The Examiner acknowledges that Agarwal et al. and Venezia et al. fail to suggest or disclose that the second species is implanted before the first species. (Office Action, Pg. 4). The applicants assert that the addition of Duo et al. does not overcome the deficiency of Agarwal et al and Venezia et al. As set forth above, Duo et al. explicitly state that "[i]t is not so efficient to exfoliate the surface in the samples implanted with helium first than in the samples implanted with hydrogen first." (Pg. 482, second column). Accordingly, the appellant asserts that Duo et al. teach the opposite implantation order compared to claim 4.

The appellant asserts that, regardless of any discussion by Duo et al. of a synergistic effect of hydrogen and helium implantation, there is still no suggestion for the particular recited implant order. This is the least because none of these references even recognize a significant difference in encouraging the growth of microcavities, without at the same time increasing the size of this distributed region at the level of the main peak. (Specification, Pg. 7, ll. 17-24).

Finally, the appellant notes that JP-11087668 to Kinji discloses implantation of He before H or (molecular hydrogen) H_2, (English Translation, pg. 4, ¶0005). There is, however, no suggestion of the implantation and diffusion of first and second chemical species as recited by claim 1.

Dependent Claim 6-7, 13 and 20

Claims 6-7, 13, and 20 stand rejected over Agarwal et al. and Venezia et al. and further in view of Kinji.

Claim 6 depends from claim 1 and recites that initiating the fracture further comprises applying a heat treatment. The Examiner acknowledges that Agarwal et al.

and Venezia et al. fail to disclose initiating a fracture by applying heat treatment. (Office Action, pg. 5). The appellant asserts that the addition of Kinji does not overcome the deficiency of the remaining references. As noted above, the appellant asserts that Kenji discloses a process in which helium and hydrogen are implanted into a substrate (11) followed by applying a support board (12), applying heat, and separating the implanted substrate. (English translation. Pg. 5-6, ¶¶ 0006-0007). As previously asserted by the appellant, Kenji teach implantation of the chemical species into the same region of the substrate. Accordingly, the appellant assert that the addition of Kinji does not overcome the failure of the primary references to establish a *prima facie* a case of obviousness.

Claim 7 depends from claim 5, which in turn depends from claim 1. This claim recites, *inter alia*, applying a heat treatment to diffuse at least a portion of the at least one second chemical species and simultaneously diffusing the at least one second chemical species and initiating the fracture along the first depth. The Examiner acknowledges that Agarwal et al. and Venezia et al. fail to disclose simultaneously diffusing at least a portion of the second chemical species. (Office Action, pg. 5). As asserted above Kinji fails to suggest or disclose the implantation and diffusion elements of claim 1. Accordingly, the appellant assert that the addition of Kinji does not overcome the failure of the primary references to establish a *prima facie* a case of obviousness.

Claim 13 depends from claim 1 and recites the additional element applying a thickener to the substrate to serve as a support for the thin layer after fracture. The Examiner acknowledges that Agarwal et al. and Venezia et al. fail to disclose applying a thickener to the substrate. (Office Action, pg. 5). As asserted above Kinji fails to suggest or disclose the implantation and diffusion elements of claim 1. Accordingly, the appellant assert that the addition of Kinji does not overcome the failure of the primary references to establish a *prima facie* a case of obviousness.

Claim 20 depends from claim 6, which in turn depends from claim 1. This claim recites simultaneously diffusing at least a portion of the at least one second chemical species from the second depth into the weak buried region, and initiating the

fracture along the first depth, and initiating a fracture by applying a heat treatment. Examiner acknowledges that Agarwal et al. and Venezia et al. fail to disclose the recited elements. (Office Action, pg. 5). As asserted above Kinji fails to suggest or disclose the implantation and diffusion elements of claim 1. Accordingly, the appellant assert that the addition of Kinji does not overcome the failure of the primary references to establish a *prima facie* a case of obviousness.

III. THE DIFFERNCES BETWEEN CLAIMS 8-9 AND 21-23 AND THE CITED REFENENCES

Claims 8-9 and 21-22 depend from claim 1 and recite, *inter alia*, a method in which applying a heat treatment is performed within a lower thermal budget than would be realized in the absence of implanting and diffusing a second chemical species. These claims stand rejected over Agarwal et al. and Venezia et al.

The subject matter recited by 8-9 and 21-22 represents a particular advantageous aspect of the appellant's claimed method. The method of claims 1 and 23 fabricate a thin film with less thermal energy compared to the prior art methods. (Specification, pg. 8, ll. 11-22). As set for the above, the predetermined time/temperature regime is known to those skilled in the art as the "thermal budget." (Specification, pg. 8, ll. 11-22) The Examiner cites particular time/temperature conditions described by Agarwal et al. and, by way of contrast with a comparative example described by the appellant, and concludes that Agarwal et al. disclose a reduced thermal budget. (Office Action, pg. 3). Thus, the Examiner attempts to use the appellant's own specification to supplement the teaching of Agarwal et al. *Id.* The appellant asserts that Agarwal et al. do not disclose thermal budget relationships associated with the claimed method. Likewise, Venezia et al. also fail to disclose any that by way of the recited implant and diffusion process, the thermal diffusion process can be carried out to provide a thermal budget as defined by the rejected claims.

Claim 9 and an alternative process of independent claim 23 recite, inter alia, that the heat treatment to diffuse the second chemical species is within a first thermal

budget by implanting additional amounts of a second chemical species. The appellant asserts that the cited references do not disclose implanting additional amounts of a second chemical species. The appellant asserts that, instead, Agarwal et al. teach a reduction in the needed quantities of implanted species, not the use of additional amounts. (Pg. 1088, first full paragraph in left column and extending to right column).

The Examiner acknowledges that Agarwal et al. fail to disclose implanting He outside the buried weak region, but asserts that Venezia et al. disclose implanting He deeper in the substrate. (Office Action, pg. 3). The appellant asserts that the cited references, taken alone or in combination, fail disclose diffusing the second chemical species by a thermal treatment at a reduced thermal budget. The appellant asserts that the claimed method is not disclosed inherently or otherwise.

Independent claim 23 recites a method similar to claim 1, with the alternative feature that the method is carried out by either applying a heat treatment for less time and at a lower temperature then that necessary in the absence of step b), or by implanting an additional amount of the at least one second chemical species to avoid exceeding a predetermined time/temperature regime. As set forth above, the appellant asserts that Agarwal et al. and Venezia et al. do not disclose thermal budget relationships associated with the method recited by claim 23. Neither of these references disclose additional amounts of a second chemical species and the associated reduced thermal diffusion level compared to the absence of the second chemical species.

IV. ONE OF ORDINARY SKILL IN THE ART WOULD NOT BE MOTIVATED TO THE COMBINE THE CITED REFERENCES

A person skilled in this art is at least a highly trained engineer have the necessary education and experience to deal with highly complex, computer-driven mechanical and analysis systems. The appellant asserts that one skilled in the art would not combine Venezia et al. with Agarwal et al., at least because Venezia et al. discourages the method recited by independent claims 1 and 23. The appellant asserts

that despite the disclosure by Venezia et al. of implanting hydrogen and helium at different implantation energies, one skilled in the art would not understand Venezia et al. to recognize any benefit associated with the disparate implantation energies.

When the entire description provided by Venezia et al is considered, it is clear that one skilled in the art would not be motivated to combine Venezia et al. and Agarwal et al. in the manner suggested by the Examiner. The appellant asserts that all portions of a cited reference must be considered, that which supports a finding of similarity between the reference and the claimed invention, and that which does not. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1553, 220 USPQ 303, 312 (Fed. Cir. 1983).

Venezia et al. describe exploratory experimental work in which the degree of lattice damage and blister formation is investigated for different processing conditions (See, Abstract). First, Venezia et al. are interested in the amount of substrate damage induced by the implantation of helium. (Venezia et al., Pg. 1386, second full paragraph). In particular, as set for the above, Venezia et al. focus on the damage induced by He, the co-implanted ion, from the physical effects of the He gas. To analyze the damage caused by He, Venezia et al. implant He deeper than H. The conclusion reached by Venezia et al. is that He damage does not improve the efficiency of surface blistering at lower doses. The appellant asserts that one skilled in the art would understand Venezia et al. to teach that the implantation of H and He at different depths is useless and thus not recommended.

Venezia et al. describe other experiments in which H and He were co-implanted at low temperatures and they further investigated the co-implantation of Li. The appellant assert that Venezia et al. merely investigate the effects of varying process parameters in order to better understand the interaction of process parameters with respect to changes in the morphology of the substrate. A person skilled in the art would thus find no interest using the teaching of Venezia et al. in the context of Agarwal et al. Venezia et al. do not suggest a technical advantage that would improve the process described in Agarwal et al., for example, such as improving the

surface quality. The appellant asserts that this advantage is only realized by the inventive method, as defined by the appellant's claims.

Secondly, although Venezia et al. explore aspects of the process in which He is implanted to a deeper depth than H, Venezia et al. conclude, as set forth above, that the effects of the damage induced by the He did not play a significant role in enhancing the formation of the surface blisters. (Venezia et al., Pg. 1386, second full paragraph). Venezia et al. further conclude that blistering is more efficient when the He is implanted in the same region as the H. (Venezia et al., Pg. 1388, leading paragraph). The appellant asserts that Venezia et al. teach that it is preferable to implant hydrogen and helium to the same depth in the substrate. Venezia et al. explicitly state that implantation of helium and hydrogen is more efficient when carried out at the same implant depth.

Accordingly, the appellant asserts that one skilled in the art would not find Venezia et al. to suggest that the implantation process disclosed by Agarwal et al. should be modified to implant helium at a greater depth in the substrate than hydrogen. This is at least because Venezia et al. teaches away from implanting hydrogen and helium at different depths in the substrate. A finding that a reference teaches away can preclude a finding that the reference renders a claim obvious. *In re Chapman*, 595 F. 3d 1330, 1337, 93 USPQ2d, 1713, 1717 (Fed. Cir. 2010) ("An inference of nonobviousness is especially strong where the prior art's teachings undermine the very reason being proffered as to why a person of ordinary skill would have combined the known elements." *Quoting DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 567 F. 3d 1314, 1326, 1873 (Fed. Cir. 2009).

The Examiner points to the Supreme Court's decision in *KSR International Co. v. Teleflex Inc.* to support the rejection. (Office Action, pg. 4). According to the asserted rationale, one skilled in the art should combine these references in because the combination "leads to the anticipated success." The appellant asserts that the Court did not eliminate consideration of the teaching, suggestion, or motivation test to judge the combination of references to produce a *prima facie* case of obviousness. *KSR International Co. v. Teleflex Inc.*, 550 U.S. 398, 418, 82 USPQ2d 1385, 1396

(U.S. 2007). Accordingly, the appellant asserts that a *prima facie* a case of obviousness has not been established by the combination of cited references at least in view of the failure to establish why one skilled in the art would be motivated to combine the teachings of Venezia et al. with Agarwal et al. in view of the teaching away by Venezia et al. Considering that a number of authors of the cited references are leading experts in the fabrication of semiconductor thin films, if the combination suggested by the Examiner was indeed obvious and would result from some straightforward combination of Venezia et al. and Agarwal et al., the noted absence of such a teaching in the art as of the priority filing date of the instant application belies the failure of the cited references to suggest the appellant' claims.

Further, given the discouragement of implanting hydrogen and helium at different depths by Venezia et al., the appellant assert that the only place where one skilled in the art would find a suggestion to combine these references is in the appellant' pending claims. The appellant assert that it is improper to combine references and assert obviousness where the combination originates solely from hindsight reasoning. The appellant asserts that the only place that one skilled in the art would find a suggestion for picking out a non-emphasize, and discouraged relative implantation energy relationship from Venezia et al. comes from the appellant's claims. Accordingly, a *prima facie* case of obviousness has not been established.

V. CONCLUSION

For the reasons set forth above, it is submitted that appellant's claims are not obvious over the cited references taken alone or in combination. The appellant asserts a *prima facie* case of obviousness and has not been established. Accordingly, this rejection is improper and the appellant respectfully requests that it be reversed.

Respectfully submitted,

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CLAIMS APPENDIX

The claims under appeal are listed below.

1. A method of fabricating a thin layer, in which a weak buried region is created by implanting a chemical species in a substrate in order to thereafter initiate a fracture of the substrate along the weak region to detach the thin layer therefrom, the method comprising:

a) implanting a first chemical species in the substrate at a first depth to form the weak buried region;

b) implanting at least one second chemical species, in the substrate at a second depth different from the first depth and at an atomic concentration higher than the atomic concentration of the first chemical species,

wherein the at least one second chemical species is less effective than the first chemical species at weakening the substrate and resides outside of the weak buried region, and

wherein steps a) and b) can be executed in either order;

c) diffusing at least a portion of the at least one second chemical species from the second depth into the weak buried region, and

d) initiating the fracture along the first depth.

2. A fabrication method according to claim 1, wherein the second depth is greater than the first depth.

3. A fabrication method according to claim 1, wherein the second depth is less than the first depth.

4. A fabrication method according to claim 2, wherein implanting at least one second chemical species is carried out before implanting the first chemical species.

5. A fabrication method according to claim 1, wherein diffusing at least a

portion of the second chemical species further comprises applying a heat treatment.

6. A fabrication method according to according to claim 1, wherein initiating the fracture further comprises applying a heat treatment.

7. A fabrication method according to according to claim 5, wherein steps c) and d) are carried out simultaneously.

8. A fabrication method according to according to claim 5, wherein applying the heat treatment comprises carrying out the heat treatment within a first thermal budget, wherein the first thermal budget is lower than a second thermal budget that would be necessary to initiate the fracture in the absence of steps b) and c).

9. A fabrication method according to claim 5, wherein applying the heat treatment comprises carrying out the heat treatment within a first thermal budget by implanting an additional amount of the at least one second chemical species, such that the first thermal budget is lower than a second thermal budget required in the absence of the additional amount of the at least one second chemical species.

10. A fabrication method according to claim 5, wherein applying the heat treatment comprises one or more of heating in a furnace, heating, or laser heating.

11. A fabrication method according to wherein initiating the fracture includes applying mechanical stresses.

12. A fabrication method according to claim 11, wherein applying the mechanical stresses comprises one or more of applying a jet of fluid, inserting a blade into the implanted region, applying traction, applying shear or bending stresses to the substrate, or applying acoustic waves.

13. A fabrication method according to claim 1, wherein, before or during initiating the fracture, a thickener is applied to the substrate to serve as a support for the thin layer after the fracture of the thin layer from the substrate.

14. A fabrication method according to claim 1, wherein, before or during initiating the fracture, a handle support is applied to the substrate, after which the thin layer is transferred onto a final support.

15. A fabrication method according to claim 1 wherein the first chemical species comprises hydrogen ions.

16. A fabrication method according to claim 1, wherein the at least one second chemical species comprises at least one rare gas.

17. A thin layer fabricated by a method according to claim 1.

18. A thin layer according to claim 17, further comprising a support underlying the thin layer.

19. A fabrication method according to claim 3, wherein implanting at least one second chemical species is carried out before implanting the first chemical species.

20. A fabrication method according to according to claim 6,wherein steps c) and d) are carried out simultaneously.

21. A fabrication method according to according to claim 6, wherein applying the heat treatment comprises carrying out the heat treatment within a first thermal budget, wherein the first thermal budget is lower than a second thermal budget that would be necessary to initiate the fracture in the absence of steps b) and c).

22. A fabrication method according to according to claim 7, wherein applying the heat treatment comprises carrying out the heat treatment within a first thermal budget, wherein the first thermal budget is lower than a second thermal budget that would be necessary to initiate the fracture in the absence of steps b) and c).

23. A method of fabricating a thin layer, in which a weak buried region is created by implanting a chemical species in a substrate in order to thereafter initiate a fracture of the substrate along the weak region to detach the thin layer therefrom, the method comprising:

a) implanting a first chemical species in the substrate at a first depth to form the weak buried region;

b) implanting at least one second chemical species, in the substrate at a second depth different from the first depth and at a concentration higher than the concentration of the first chemical species,

wherein the at least one second chemical species is less effective than the first chemical species at weakening the substrate and resides outside of the weak buried region, and

wherein steps a) and b) can be executed in either order;

c) diffusing at least a portion of the at least one-second chemical species from the second depth into the weak buried region, and

d) initiating the fracture along the first depth,

wherein the method is carried out by either applying a heat treatment for less time and at a lower temperature then that necessary in the absence of step b), or by implanting an additional amount of the at least one second chemical species to avoid exceeding a predetermined time/temperature regime.

EVIDENCE APPENDIX

The appellant has not submitted evidence pursuant to 37 CFR §§ 1.130, 1.131 or 1.132, or other evidence in the instant application.

RELATED PROCEEDING APPENDIX

The appellants have not filed any other related appeals and there are no BPAI or court decisions related to the instant application.